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EXAMINER	
WONG, ALLEN C	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/676,577	Applicant(s) JIANG, HONG	
	Examiner Allen Wong	Art Unit 2621	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 November 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7,10-15,18,19,22-25,28 and 29* is/are rejected.

7)☒ Claim(s) *8,9,16,17,20,21,26 and 27* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/5/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/5/07 has been entered.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 11/5/07 has been considered by the examiner.

Response to Arguments

3. Applicant's arguments filed 11/5/07 have been fully considered but they are not persuasive.

The 101 rejection is withdrawn based on amendment.

4. Applicant's arguments with respect to claims 1-7,10-15,18,19,22-25,28 and 29, have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-7,10-15,18,19,22-25,28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hanami (6,122,317) in view of Zhu et al ("A New Diamond Search Algorithm for Fast Block-Matching Motion Estimation", IEEE Transaction on Image Processing, Vol.9, No.2, Feb.2000).

Regarding claims 1 and 4, Hanami discloses a method and video encoder comprising:

a motion estimator to perform a motion search on input video data relative to a reference video frame to generate a plurality of motion vectors (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block", and col.11, ln.32-44, Hanami discloses that optimum vector decision part 4 is used to determine the optimum motion vectors to generate plural motion vectors); and

a variable length coder to compress the input video data using the motion vectors (col.11, ln.60-65, elements 7 and 8 of fig.2 are variable length coders used for coding input video data).

Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical

dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose a motion measurement on a plurality of motion search points that form a search region, each of the plurality of motion search points corresponding to a pixel block, wherein a minimal motion search point among the plurality of motion search points is found based on result of the motion measurement, and a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the search region.

However, Zhu teaches the use of the motion measurement on the plurality of motion search points that form the search region, each of the plurality of motion search points corresponding to a pixel block, wherein the minimal motion search point among the plurality of motion search points is found based on result of the motion measurement (see page 287, section III, where Zhu discloses the use of large diamond search pattern and small diamond search pattern for finding the MBD, the minimum block distortion that occurs at the central point, as seen in fig.2 on page 288, wherein the large diamond search pattern discloses plural search points corresponding to a pixel block, and the MBD or minimal motion search point is among the plural motion search points, as the minimal motion search point occurs at the central point); and a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner

region of the search region (see page 287-288, Zhu discloses in fig.2a, a large diamond search pattern is employed and then further refinement via small diamond search pattern in fig.2b. is used, also see fig.3c, where LDSP is initially used, then SDSP is used for refining the motion search within the inner search region). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claims 2 and 5, Hanami discloses further comprising: a transformer to transform the input video data in real-domain (col.2, ln.22-24 and fig.84, element 926); and a quantization unit to quantize the transformed video data (col.2, ln.24-26 and fig.84, element 928).

Regarding claims 3 and 6, Hanami discloses further comprising a frame memory, coupled to the motion estimator, to store the reference frame (col.2, ln.28-33, memory is used to store the reference frame; col.12, ln.56-60, reference frame is stored).

Regarding claims 7 and 19, Hanami discloses a computer readable medium encoded with a computer program having computer executable instructions, a method to determine relative movement of a pixel block from a first video frame to a second video frame (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block",), the method comprising: finding a motion vector corresponding

to the relative movement of the pixel block from the first video frame to the second video frame (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block", and col.11, ln.32-44, Hanami discloses that optimum vector decision part 4 is used to determine the optimum motion vectors to generate plural motion vectors).

Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose performing a motion measurement on a plurality of motion search points that form a rectangular search region, each of the plurality of motion search points corresponding to a pixel block; finding a minimal motion search point among the plurality of motion search points based on result of the motion measurement; and performing a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the rectangular search region.

However, Zhu teaches the use of performing motion measurement on the plurality of motion search points that form the search region, each of the plurality of motion search points corresponding to a pixel block, wherein the minimal motion search point among the plurality of motion search points is found based on result of the motion measurement (see page 287, section III, where Zhu discloses the use of large diamond search pattern and small diamond search pattern for finding the MBD, the minimum block distortion that occurs at the central point, as seen in fig.2 on page 288, wherein the large diamond search pattern discloses plural search points corresponding to a pixel block, and the MBD or minimal motion search point is among the plural motion search points, as the minimal motion search point occurs at the central point); and a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the search region (see page 287-288, Zhu discloses in fig.2a, a large diamond search pattern is employed and then further refinement via small diamond search pattern in fig.2b. is used, also see fig.3c, where LDSP is initially used, then SDSP is used for refining the motion search within the inner search region). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claims 10 and 22, Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the

inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if t1≠ t2 ≠ r1 ≠ r2 ≠ P ≠ Q, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose further comprising: dividing the search region into a plurality of data units, each of the plurality of data units having substantially the same size and a distinct subset of the plurality of motion search points, wherein the motion measurement is performed in each of the plurality of data units one by one. However, Zhu teaches dividing the search region into a plurality of data units (page 288, fig.2a and 2b, Zhu discloses the search region is divided into plural data units, as seen with each dot represent data unit), each of the plurality of data units having substantially the same size and a distinct subset of the plurality of motion search points (page 288, fig.2a and 2b, Zhu discloses the search region is divided into plural data units, as seen with each dot represent data unit, each data unit having the substantially same size), wherein the motion measurement is performed in each of the plurality of data units one by one (see page 287, section III, where Zhu discloses the use of large diamond search pattern and small diamond search pattern for finding the MBD, the minimum block distortion that occurs at the central point, as seen in fig.2 on page 288, wherein the large diamond search pattern discloses plural search points corresponding to a pixel

block, and the MBD or minimal motion search point is among the plural motion search points, as the minimal motion search point occurs at the central point, point by point). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claims 11 and 23, Hanami does not specifically disclose wherein the rectangular search region is a square search region having 16 motion search points.

Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Zhu discloses the diamond search region for the large diamond search pattern with motion search points (fig.2a, the diamond search region is essentially a square, but tilted at a 45 degree angle, the search region has nine motion search points). Since Hanami discloses the variable motion search region, as stated above, it would have been obvious to one of ordinary skill in the art to take Zhu's teaching and modify the

size of the diamond to include 16 motion search points or however many search points needed to form a square search pattern so as to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Regarding claims 12 and 24, Hanami does not specifically disclose wherein the square search region is divided into 4 data units, each of the 4 data units has 4 distinct motion search points. However, Zhu discloses the diamond search region for the large diamond search pattern with motion search points (fig.2a, the diamond search region is essentially a square, but tilted at a 45 degree angle, the search region has nine motion search points). Since Hanami discloses the variable motion search region, as stated above, it would have been obvious to one of ordinary skill in the art to take Zhu's teaching and modify the size of the diamond to include 16 motion search points or however many search points, search subdivisions, or data units needed to form a square search pattern so as to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Regarding claim 13, Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the

search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose wherein performing the refinement motion search comprises shrinking the rectangular search region at the minimal point if the minimal motion search point is within the inner region of the rectangular search region. However, Zhu teaches the refinement motion search comprises the shrinking search region at the minimal point if the minimal motion search point is within the inner region of the search region (see page 287-288, Zhu discloses in fig.2a, a large diamond search pattern is employed and then further refinement via small diamond search pattern in fig.2b. is used, also see fig.3c, where LDSP is initially used, then SDSP is used for refining the motion search within the inner search region, thus, the search region is shrinked). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claim 14, Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the

search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose further comprising performing a sub-pixel motion search around the minimal point if the minimal motion search point is within an inner region of the rectangular search region. However, Zhu teaches performing a sub-pixel motion search around the minimal point if the minimal motion search point is within an inner region of the search region (see page 287-288, Zhu discloses in fig.2a, a large diamond search pattern is employed and then further refinement via small diamond search pattern in fig.2b. is used, also see fig.3c, where LDSP is initially used, then SDSP is used for refining the motion search within the inner search region). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claim 15, Hanami discloses a method to compress video data comprising: defining a first video frame as a reference video frame (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block");

performing a motion search on a second video frame relative to the reference video frame to determine a plurality of motion vectors of the second video frame relative

to the reference video frame (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block", and col.11, ln.32-44, Hanami discloses that optimum vector decision part 4 is used to determine the optimum motion vectors to generate plural motion vectors); and

finding a motion vector corresponding to the relative movement of the pixel block from the first video frame to the second video frame (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block", and col.11, ln.32-44, Hanami discloses that optimum vector decision part 4 is used to determine the optimum motion vectors to generate plural motion vectors).

Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the

motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose reducing the video data to the reference video frame and the plurality of motion vectors of the second video frame, wherein the motion search includes performing motion measurement on a plurality of motion search points that form a rectangular search region each of the plurality of motion search points corresponding to a pixel block; finding a minimal motion search point among the plurality of motion search points based on result of the motion measurement; and performing a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the rectangular search region.

However, Zhu teaches the use of performing motion measurement on the plurality of motion search points that form the search region, each of the plurality of motion search points corresponding to a pixel block, wherein the minimal motion search point among the plurality of motion search points is found based on result of the motion measurement (see page 287, section III, where Zhu discloses the use of large diamond search pattern and small diamond search pattern for finding the MBD, the minimum block distortion that occurs at the central point, as seen in fig.2 on page 288, wherein the large diamond search pattern discloses plural search points corresponding to a pixel block, and the MBD or minimal motion search point is among the plural motion search points, as the minimal motion search point occurs at the central point); and a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the search region (see page 287-288, Zhu discloses in fig.2a, a large diamond

search pattern is employed and then further refinement via small diamond search pattern in fig.2b. is used, also see fig.3c, where LDSP is initially used, then SDSP is used for refining the motion search within the inner search region). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claim 18, Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose further comprising: dividing the search region into a plurality of data units, each of the plurality of data units having substantially the same size and a distinct subset of the plurality of motion search points, wherein the motion measurement is performed in each of the plurality of data units one by one. However, Zhu teaches dividing the search region into a plurality of data units (page 288,

fig.2a and 2b, Zhu discloses the search region is divided into plural data units, as seen with each dot represent data unit), each of the plurality of data units having substantially the same size and a distinct subset of the plurality of motion search points (page 288, fig.2a and 2b, Zhu discloses the search region is divided into plural data units, as seen with each dot represent data unit, each data unit having the substantially same size), wherein the motion measurement is performed in each of the plurality of data units one by one (see page 287, section III, where Zhu discloses the use of large diamond search pattern and small diamond search pattern for finding the MBD, the minimum block distortion that occurs at the central point, as seen in fig.2 on page 288, wherein the large diamond search pattern discloses plural search points corresponding to a pixel block, and the MBD or minimal motion search point is among the plural motion search points, as the minimal motion search point occurs at the central point, point by point). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claim 25, Hanami discloses a system comprising:

a dynamic random access memory (DRAM) device (col.2, ln.28-33, memory is used to store the reference frame; col.12, ln.56-60, reference frame is stored); a memory controller coupled to the DRAM device (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the

motion search has a "search window block", and that the memory can store the image data, thus, since the retrieval or storage of data is done, the memory controller must be active to permit data to be retrieved or stored); and

a parallel processor chip coupled to the memory controller, the parallel processor chip comprising a plurality of registers defining a register file (col.14, ln.19-40; Hanami discloses the use of a processor for processing data, wherein fig.6, the data from Y and X have data going through a plurality of registers; col.45, ln.18-33); and a parallel processor coupled to the plurality of registers, wherein the parallel processor is operable to perform operations to determine relative movement of a pixel block from a first video frame to a second video frame (col.14, ln.41-64, Hanami discloses that the PE of fig.6 is a processor that has a plurality of data registers operated to determine relative movement of a pixel block, wherein col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block"), the operations comprising:

finding a motion vector corresponding to the relative movement of the pixel block from the first video frame to the second video frame (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block", and col.11, ln.32-44, Hanami discloses that optimum vector decision part 4 is used to determine the optimum motion vectors to generate plural motion vectors).

Hanami does not specifically disclose the rectangular motion search or rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Hanami does not specifically disclose performing a motion measurement on a plurality of motion search points that form a search region each of the plurality of motion search points corresponding to a pixel block; finding a minimal motion search point among the plurality of motion search points based on result of the motion measurement; and performing a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the search region.

However, Zhu teaches the use of performing motion measurement on the plurality of motion search points that form the search region, each of the plurality of motion search points corresponding to a pixel block, wherein the minimal motion search point among the plurality of motion search points is found based on result of the motion measurement (see page 287, section III, where Zhu discloses the use of large diamond search pattern and small diamond search pattern for finding the MBD, the minimum

block distortion that occurs at the central point, as seen in fig.2 on page 288, wherein the large diamond search pattern discloses plural search points corresponding to a pixel block, and the MBD or minimal motion search point is among the plural motion search points, as the minimal motion search point occurs at the central point); and a refinement motion search on a sub-pixel level if the minimal motion search point is within an inner region of the search region (see page 287-288, Zhu discloses in fig.2a, a large diamond search pattern is employed and then further refinement via small diamond search pattern in fig.2b. is used, also see fig.3c, where LDSP is initially used, then SDSP is used for refining the motion search within the inner search region). Therefore, it would have been obvious to one of ordinary skill in the art to combine the teachings of Hanami and Zhu, as a whole, for producing a simple, robust and efficient motion search algorithm (page 287, section I, third paragraph).

Regarding claim 28, Hanami discloses the parallel processor loads a plurality of data elements into the region within the register file (col.14, ln.19-40; Hanami discloses the use of a processor for processing data, wherein fig.6, the data from Y and X have data going through a plurality of registers; col.45, ln.18-33).

Hanami does not specifically disclose the rectangular region corresponding to the rectangular search region. However, it would have been obvious to one of ordinary skill in the art to apply Hanami's teaching of forming a variable motion search area (col.14, ln.11-18, Hanami discloses, in fig.5, there is the inner region 20 of the rectangular search area 22 with horizontal dimensions ranging from -t2 to +t1, and vertical dimensions ranging from -r2 to +r1, wherein if $t1 \neq t2 \neq r1 \neq r2 \neq P \neq Q$, then the search

area can be constructed to form a rectangular search region). Therefore, it would have been obvious to one of ordinary skill in the art to adjust the search region to meet the motion vector search application at hand for facilitating the convenience of searching for motion vectors in an accurate, efficient manner.

Regarding claim 29, Hanami discloses further comprising a microprocessor coupled to the memory controller (col.10, ln.57 to col.11, ln.11, Hanami discloses that a motion search is done for input video data relative to a reference frame, ie. "reference screen image block" versus the "current screen image block", wherein the motion search has a "search window block", and that the memory can store the image data, thus, since the retrieval or storage of data is done, the memory controller must be active to permit data to be retrieved or stored, thus, the microprocessor must be coupled to permit the memory controller to instruct the retrieval or storage of data since Hanami does disclose a computer readable medium).

Allowable Subject Matter

7. Claims 8, 9, 16, 17, 20, 21, 26 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter: The prior art does not specifically disclose the limitation of: repositioning the rectangular search region to be substantially centered on the minimal motion search point and partially overlapping a previous position of the rectangular search region while maintaining a size of the rectangular search region to be

substantially the same if the minimal motion search point is along an edge or at a comer of the rectangular search region, the repositioned rectangular search region including a second plurality of motion search points; and performing a motion measurement on the second plurality of motion search points, as disclosed in dependent claims 8, 16, 20 and 26.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allen Wong whose telephone number is (571) 272-7341. The examiner can normally be reached on Mondays to Thursdays from 8am-6pm Flextime.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John W. Miller can be reached on (571) 272-7353. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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